

# Model Name: T320XVN01.0 (SKD)

Issue Date : 2011/09/21

(\*) Preliminary Specifications

( ) Final Specifications

Customer Signature	Date	AUO	Date
Approved By  _____		Approval By PM Director Kelly Kao  _____	
Note		Reviewed By RD Director Eugene.CC.Chen  _____	
		Reviewed By Project Leader Sarah Ke  _____	
		Prepared By PM Cloud Huang  _____	

## Contents

No		
		CONTENTS
		RECORD OF REVISIONS
1		GENERAL DESCRIPTION
2		ABSOLUTE MAXIMUM RATINGS
3		ELECTRICAL SPECIFICATION
	3-1	ELECTRICAL CHARACTERISTICS
	3-2	INTERFACE CONNECTIONS
	3-3	SIGNAL TIMING SPECIFICATION
	3-4	SIGNAL TIMING WAVEFORM
	3-5	COLOR INPUT DATA REFERENCE
	3-6	POWER SEQUENCE
4		OPTICAL SPECIFICATION
5		MECHANICAL CHARACTERISTICS
6		RELIABILITY TEST ITEMS
7		PACKING
8		PRECAUTION
	8-1	MOUNTING PRECAUTIONS
	8-2	OPERATING PRECAUTIONS
	8-3	ELECTROSTATIC DISCHARGE CONTROL
	8-4	PRECAUTIONS FOR STRONG LIGHT EXPOSURE
	8-5	STORAGE
	8-6	HANDLING PRECAUTIONS FOR PROTECT FILM

## Record of Revision

[illegible]

## 1. General Description

This specification applies to the 31.5 inch Color TFT-LCD SKD model T320XVN01.0. This LCD Open Cell Unit has a TFT active matrix type liquid crystal panel 1,366x768 pixels, and diagonal size of 31.5 inch. This Open Cell Unit supports 1,366x768 mode. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in horizontal stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot.

### \* General Information

Items	Specification	Unit	Note
Active Screen Size	31.5	inch	
Display Area	697.685(H) x 392.256(V)	mm	
Outline Dimension	716.1 (H)x 408.7 (V)	mm	
Driver Element	a-Si TFT active matrix		
Display Colors	8 bit, 16.7M	Colors	
Number of Pixels	1,366x768	Pixel	
Pixel Pitch	0.51075	mm	
Pixel Arrangement	RGB horizontal stripe		
Display Operation Mode	Normally Black		
Surface Treatment	Anti-Glare, 3H		Haze=2%

## 2. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit

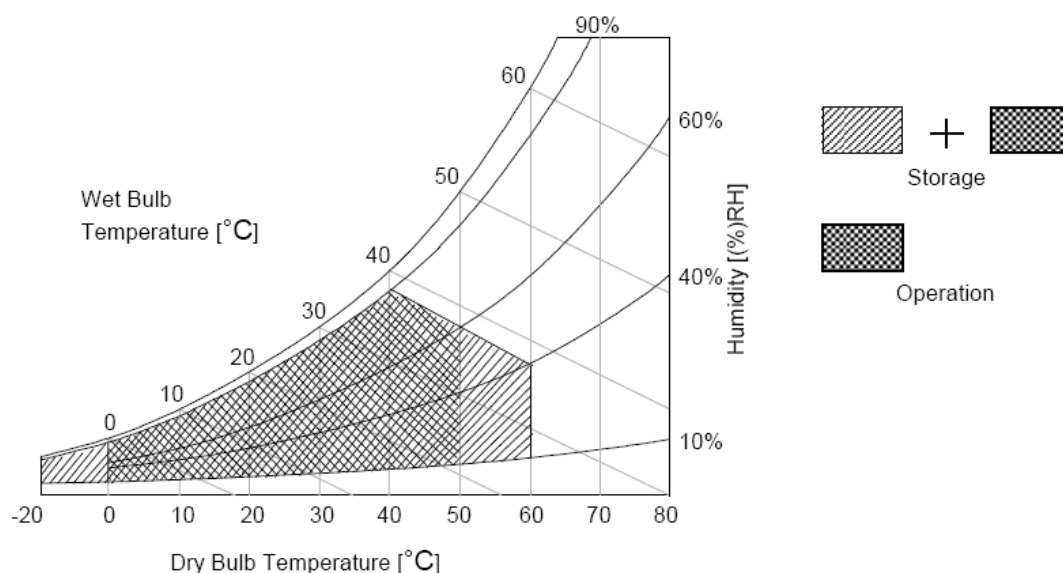
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	V0c	-0.3	14	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	4	[Volt]	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 2
Panel Surface Temperature	PST		65	[°C]	Note 3

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39°C and No condensation.

The relative humidity must not exceed 90% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 3: Surface temperature is measured at 50°C Dry condition



## 3. Electrical Specification

The T320XVN01.0 Open Cell Unit requires power input which is employed to power the LCD electronics and to drive the TFT array and liquid crystal.

### 3.1 Electrical Characteristics

#### 3.1.1: DC Characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LCD							
Power Supply Input Voltage		$V_{DD}$	10.8	12	13.2	$V_{DC}$	
Power Supply Input Current		$I_{DD}$	--	0.26	0.33	A	1
Inrush Current		$I_{RUSH}$	--		2	A	2
Permissible Ripple of Power Supply Input Voltage (for input power=12V)		$V_{RP}$	--	--	$V_{DD} * 5\%$	mV <sub>pk-pk</sub>	3
LVDS Interface	Differential Input High Threshold Voltage	$V_{TH}$	+100	--	+300	mV <sub>DC</sub>	4
	Differential Input Low Threshold Voltage	$V_{TL}$	-300	--	-100	mV <sub>DC</sub>	4
	Input Common Mode Voltage	$V_{ICM}$	1.1	1.25	1.4	$V_{DC}$	4
CMOS Interface	Input High Threshold Voltage	$V_{IH}$ (High)	2.7	--	3.3	$V_{DC}$	5
	Input Low Threshold Voltage	$V_{IL}$ (Low)	0	--	0.6	$V_{DC}$	5

#### 3.1.2: AC Characteristics

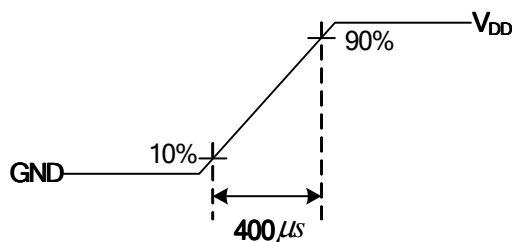
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LVDS Interface	Receiver Clock : Spread Spectrum Modulation range	Fclk_ss	Fclk -3%	--	Fclk +3%	MHz	6
	Receiver Clock : Spread Spectrum Modulation frequency	Fss	30	--	200	KHz	6
	Receiver Data Input Margin Fclk = 85 MHz Fclk = 65 MHz	tRMG	-0.4 -0.5	-- --	0.4 0.5	ns	7

**Note :**

**1. Test Condition:**

- (1)  $V_{DD} = 12.0V$
- (2)  $F_v = \text{Type Timing, 60Hz}$
- (3)  $F_{clk} = \text{Max freq.}$
- (4)  $\text{Temperature} = 25\text{ }^{\circ}\text{C}$
- (5) Typ. Input current : White Pattern  
Max. Input current: Heavy loading pattern defined by AUO

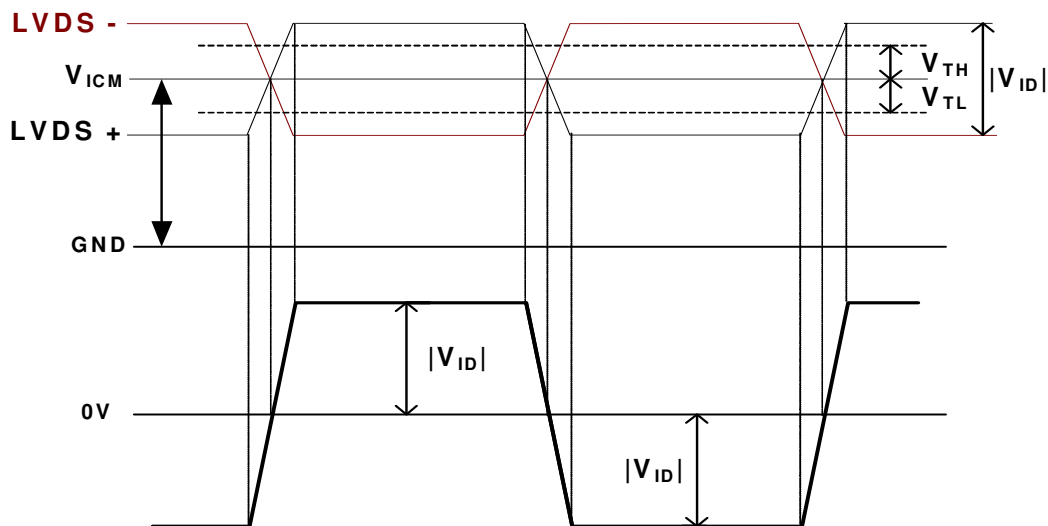
**2. Measurement condition : Rising time = 400us**



**3. Test Condition:**

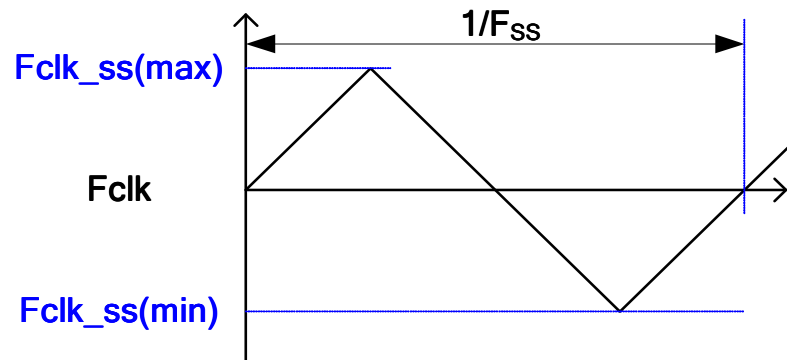
- (1) The measure point of  $V_{RP}$  is in LCM side after connecting the System Board and LCM.
- (2) Under Max. Input current spec. condition.

**4.  $V_{ICM} = 1.25V$**



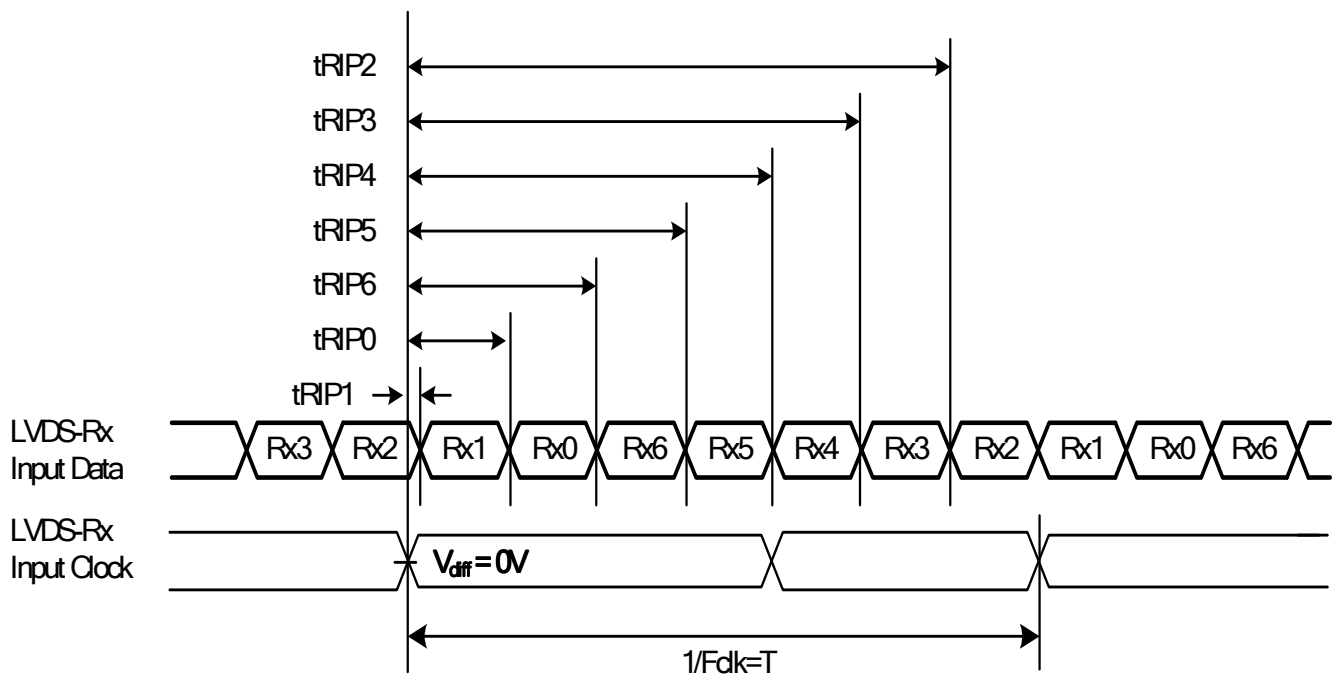
**5. The measure points of  $V_{IH}$  and  $V_{IL}$  are in LCM side after connecting the System Board and LCM.**

**6. LVDS Receiver Clock SSCG (Spread spectrum clock generator) is defined as below figures.**



## 7. Receiver Data Input Margin

Parameter	Symbol	Rating			Unit	Note
		Min	Type	Max		
Input Clock Frequency	$F_{clk}$	$F_{clk} (min)$	--	$F_{clk} (max)$	MHz	$T=1/F_{clk}$
Input Data Position0	$t_{RIP1}$	$- t_{RMG} $	0	$ t_{RMG} $	ns	
Input Data Position1	$t_{RIP0}$	$T/7 -  t_{RMG} $	$T/7$	$T/7 +  t_{RMG} $	ns	
Input Data Position2	$t_{RIP6}$	$2T/7 -  t_{RMG} $	$2T/7$	$2T/7 +  t_{RMG} $	ns	
Input Data Position3	$t_{RIP5}$	$3T/7 -  t_{RMG} $	$3T/7$	$3T/7 +  t_{RMG} $	ns	
Input Data Position4	$t_{RIP4}$	$4T/7 -  t_{RMG} $	$4T/7$	$4T/7 +  t_{RMG} $	ns	
Input Data Position5	$t_{RIP3}$	$5T/7 -  t_{RMG} $	$5T/7$	$5T/7 +  t_{RMG} $	ns	
Input Data Position6	$t_{RIP2}$	$6T/7 -  t_{RMG} $	$6T/7$	$6T/7 +  t_{RMG} $	ns	





### 3.2 Interface Connections

- LCD connector: 196225-60041 (P-TWO, FFC connector)

PIN	Symbol	Description
1	V <sub>DD</sub>	Power Supply, +12V DC Regulated
2	V <sub>DD</sub>	Power Supply, +12V DC Regulated
3	V <sub>DD</sub>	Power Supply, +12V DC Regulated
4	V <sub>DD</sub>	Power Supply, +12V DC Regulated
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	LVDS_SEL	Open/High(3.3V) for NS, Low(GND) for JEIDA
10	N.C.	AUO Internal Use Only
11	GND	Ground
12	CH1_0-	LVDS Channel 1, Signal 0-
13	CH1_0+	LVDS Channel 1, Signal 0+
14	GND	Ground
15	CH1_1-	LVDS Channel 1, Signal 1-
16	CH1_1+	LVDS Channel 1, Signal 1+
17	GND	Ground
18	CH1_2-	LVDS Channel 1, Signal 2-
19	CH1_2+	LVDS Channel 1, Signal 2+
20	GND	Ground
21	CH1_CLK-	LVDS Channel 1, Clock -
22	CH1_CLK+	LVDS Channel 1, Clock +
23	GND	Ground
24	CH1_3-	LVDS Channel 1, Signal 3-
25	CH1_3+	LVDS Channel 1, Signal 3+
26	GND	Ground
27	N.C.	AUO Internal Use Only
28	N.C.	AUO Internal Use Only
29	N.C.	AUO Internal Use Only
30	GND	Ground

### 3.3 Signal Timing Specification

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

**Timing Table (DE only Mode)**

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	Tv	784	810	1015	Th
	Active	Tdisp (v)	768			Th
	Blanking	Tblk (v)	16	42	247	Th
Horizontal Section	Period	Th	1460	1648	2000	Tclk
	Active	Tdisp (h)	1366			Tclk
	Blanking	Tblk (h)	94	282	634	Tclk
Clock	Frequency	Fclk=1/Tclk	50	80	86	MHz
Vertical Frequency	Frequency	Fv	47	60	63	Hz
Horizontal Frequency	Frequency	Fh	43	48	53	KHz

Notes:

(1) Display position is specific by the rise of DE signal only.

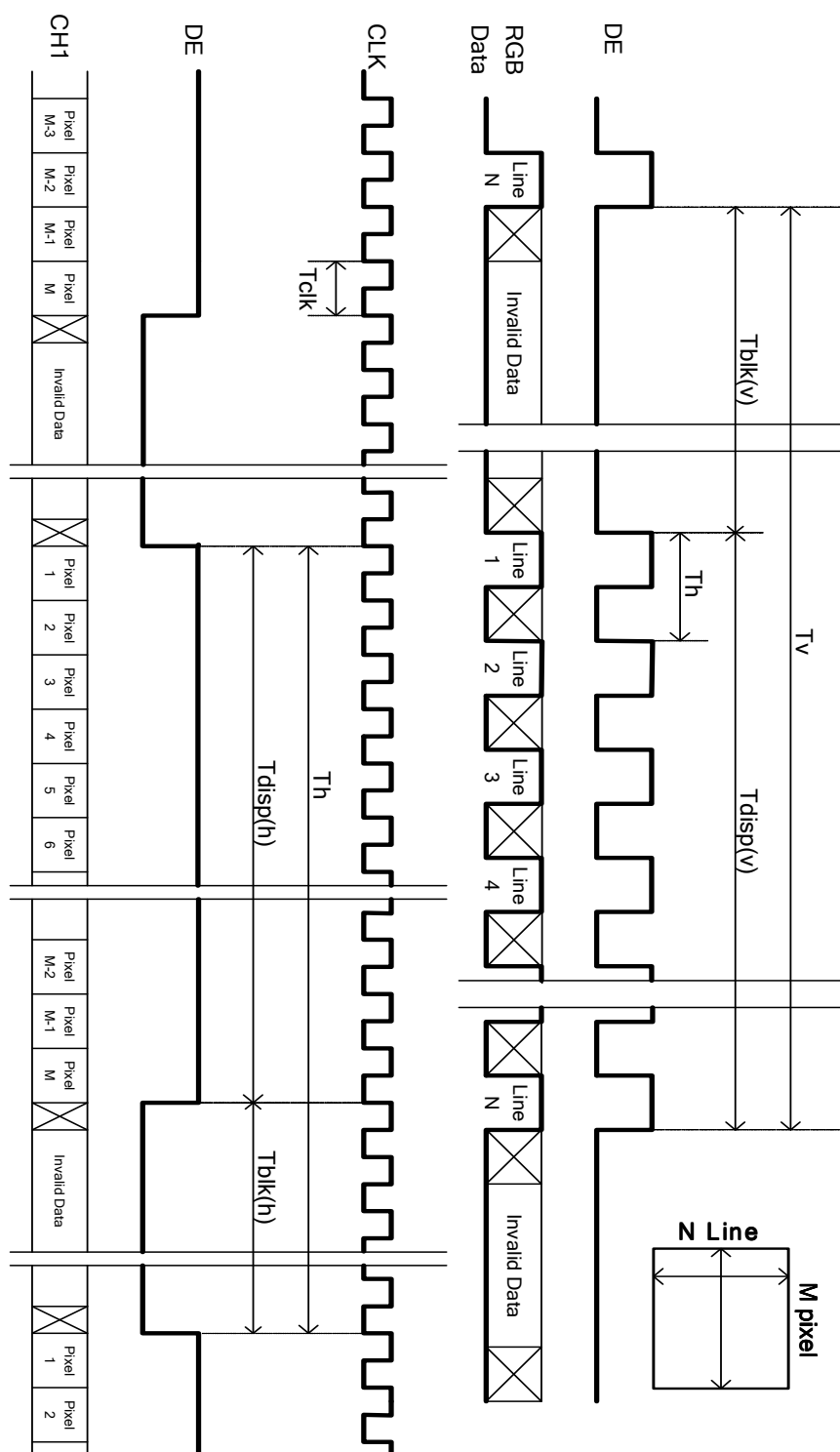
Horizontal display position is specified by the rising edge of 1<sup>st</sup> DCLK after the rise of 1<sup>st</sup> DE, is displayed on the left edge of the screen.

(2) Vertical display position is specified by the rise of DE after a "Low" level period equivalent to eight times of horizontal period. The 1<sup>st</sup> data corresponding to one horizontal line after the rise of 1<sup>st</sup> DE is displayed at the top line of screen.

(3) If a period of DE "High" is less than 1366 DCLK or less than 768 lines, the rest of the screen displays black.

(4) The display position does not fit to the screen if a period of DE "High" and the effective data period do not synchronize with each other.

### 3.4 Signal Timing Waveforms



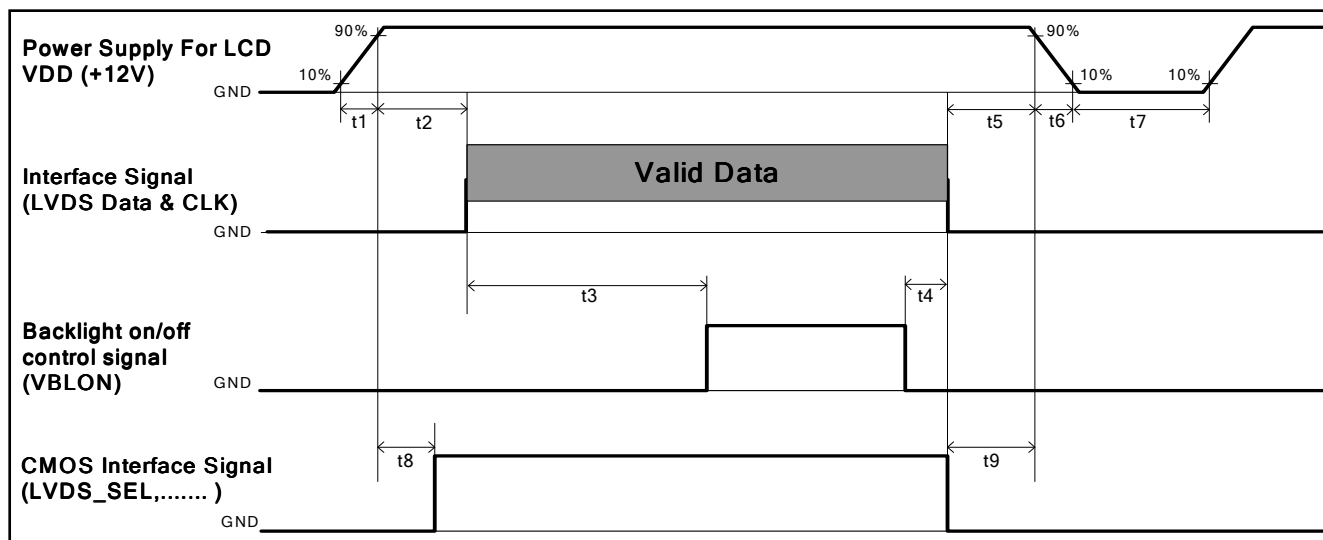
### 3.5 Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 8 bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

#### COLOR DATA REFERENCE

Color		Input Color Data																											
		RED								GREEN								BLUE											
		MSB				LSB				MSB				LSB				MSB				LSB							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0				
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
R	RED(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	RED(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	----																												
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
G	GREEN(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	GREEN(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
	----																												
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
B	BLUE(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	BLUE(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	----																												
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	

### 3.5 Power Sequence for LCD



Parameter	Values			Unit
	Min.	Type.	Max.	
t1	0.4	---	30	ms
t2	0.1	---	<b>50</b>	ms
t3	<b>450</b>	---	---	ms
t4	0 <sup>*1</sup>	---	---	ms
t5	0	---	---	ms
t6	---	---	--- <sup>*2</sup>	ms
t7	500	---	---	ms
t8	10 <sup>*3</sup>	---	50	ms
t9	0	---	---	ms

Note:

(1) t4=0 : concern for residual pattern before BLU turn off.

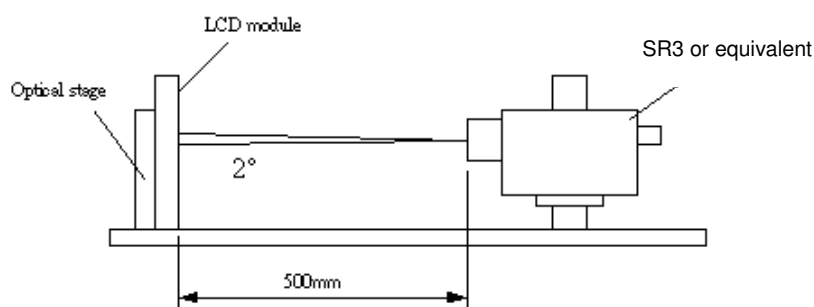
(2) t6 : voltage of VDD must decay smoothly after power-off. (customer system decide this value)

(3) When CMOS Interface signal is N.C. (no connection), opened in Transmitted end, t8 timing spec can be negligible.

## 4. Optical Specification

Optical characteristics are determined after the BLU unit has been 'ON' (note 1.) and stable for approximately 45 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of  $\phi$  and  $\theta$  equal to 0°.

**Fig.1 presents additional information concerning the measurement equipment and method.**



Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max		
Contrast Ratio		CR	2400	3000			
Surface Luminance (White)		$L_{WH}$	300	350	--	cd/m <sup>2</sup>	3
Luminance Variation		$\delta_{WHITE(9P)}$	--	--	1.33		4
Response Time (G to G)		$T_{\gamma}$	--	6.5	--	Ms	5
Color Gamut		NTSC		72		%	
Color Coordinates							
	Red	$R_x$	Typ.-0.03	0.640	Typ.+0.03		
		$R_y$		0.330			
	Green	$G_x$		0.310			
		$G_y$		0.620			
	Blue	$B_x$		0.150			
		$B_y$		0.060			
	White	$W_x$		0.280			
		$W_y$		0.290			
Viewing Angle							6
	x axis, right( $\phi=0^\circ$ )	$\theta_r$	--	89	--	degree	
	x axis, left( $\phi=180^\circ$ )	$\theta_l$	--	89	--	degree	
	y axis, up( $\phi=90^\circ$ )	$\theta_u$	--	89	--	degree	
	y axis, down ( $\phi=270^\circ$ )	$\theta_d$	--	89	--	degree	

Note:

1. All above optical specifications are defined by T320XVN01.0 module basis.
2. Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance of } L_{on5}}{\text{Surface Luminance of } L_{off5}}$$

3. Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2.
4. The variation in surface luminance,  $\delta_{WHITE}$  is defined (center of Screen) as:  

$$\delta_{WHITE(9P)} = \text{Maximum}(L_{on1}, L_{on2}, \dots, L_{on9}) / \text{Minimum}(L_{on1}, L_{on2}, \dots, L_{on9})$$
5. Response time  $T_{\gamma}$  is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on  $F_v=60\text{Hz}$  to optimize. to optimize. For more information see FIG.3

Measured Response Time		Target				
		0%	25%	50%	75%	100%
Start	0%		0% to 25%	0% to 50%	0% to 75%	0% to 100%
	25%	25% to 0%		25% to 50%	25% to 75%	25% to 100%
	50%	50% to 0%	50% to 25%		50% to 75%	50% to 100%
	75%	75% to 0%	75% to 25%	75% to 50%		75% to 100%
	100%	100% to 0%	100% to 25%	100% to 50%	100% to 75%	

6. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG4.

**FIG. 2 Luminance**

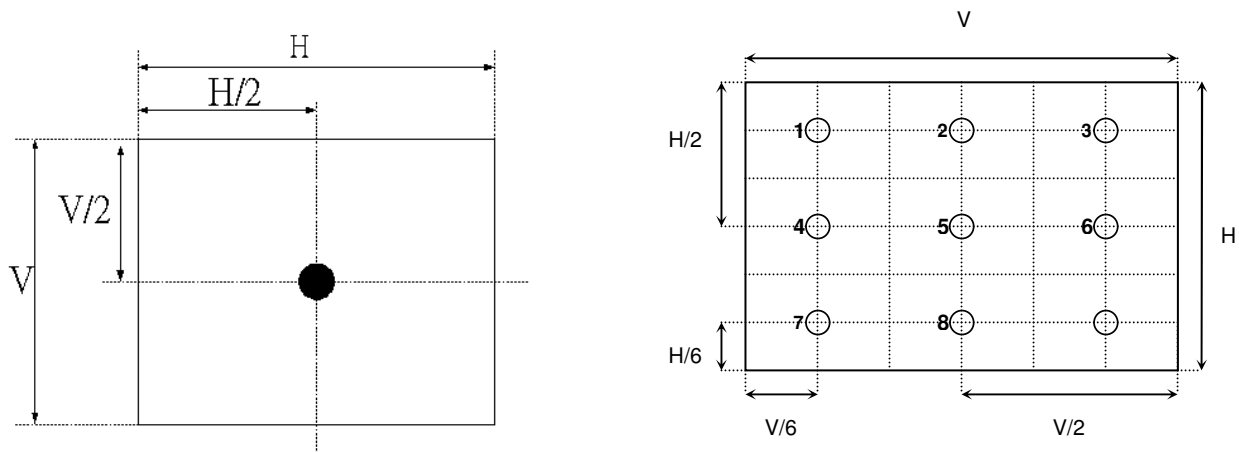


FIG.3 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “any level of gray(bright) ” and “any level of gray(dark)”.

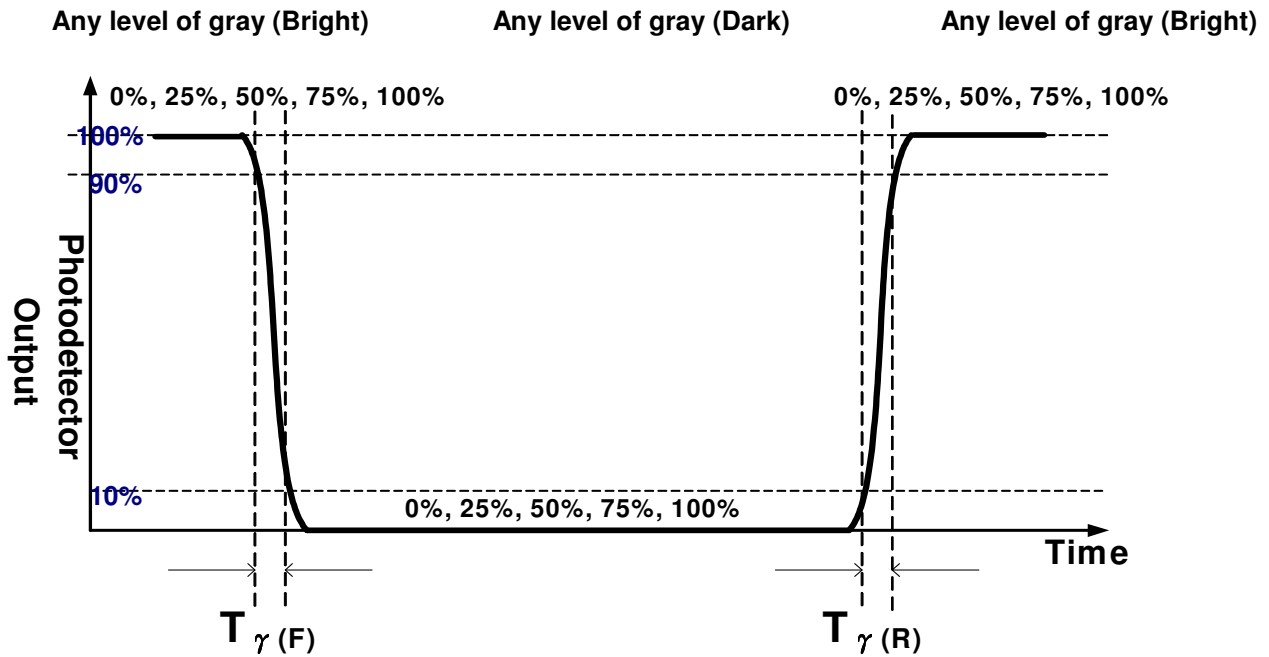
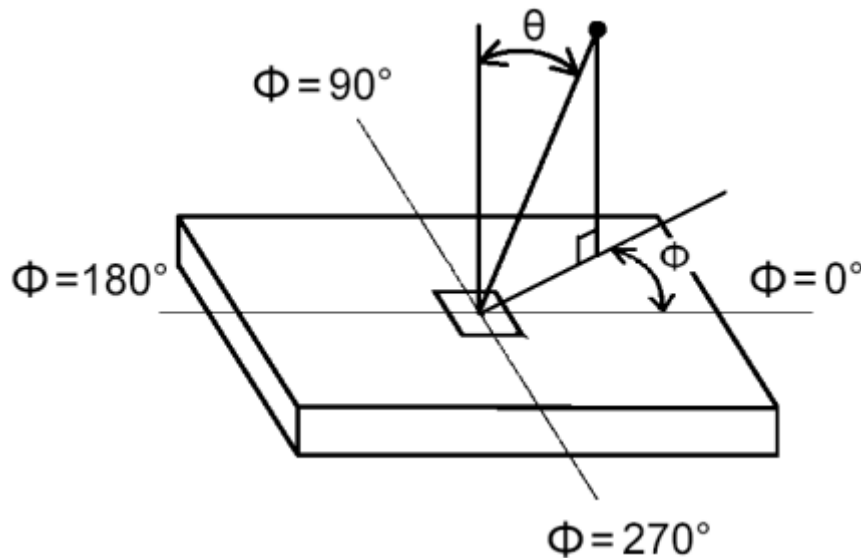
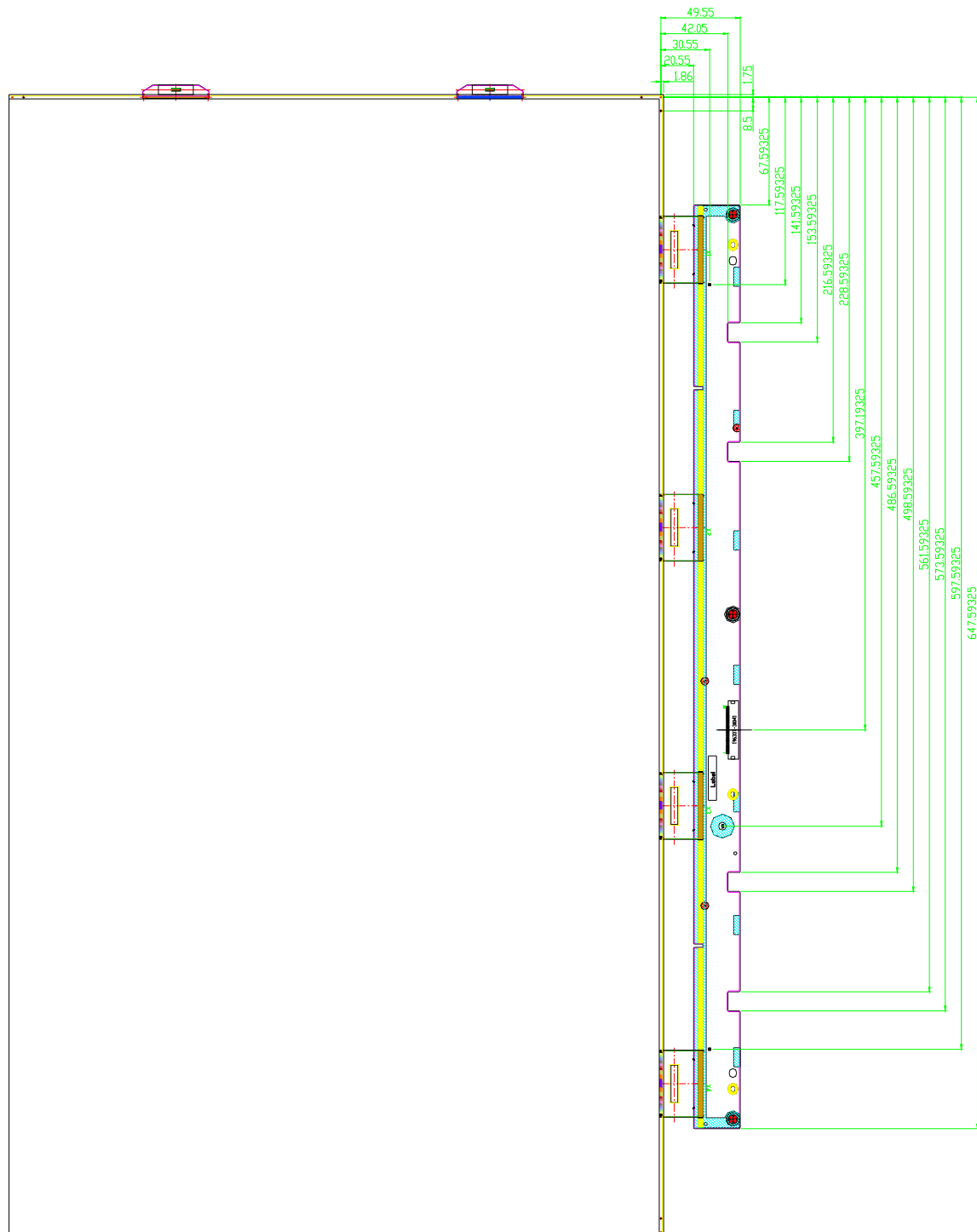


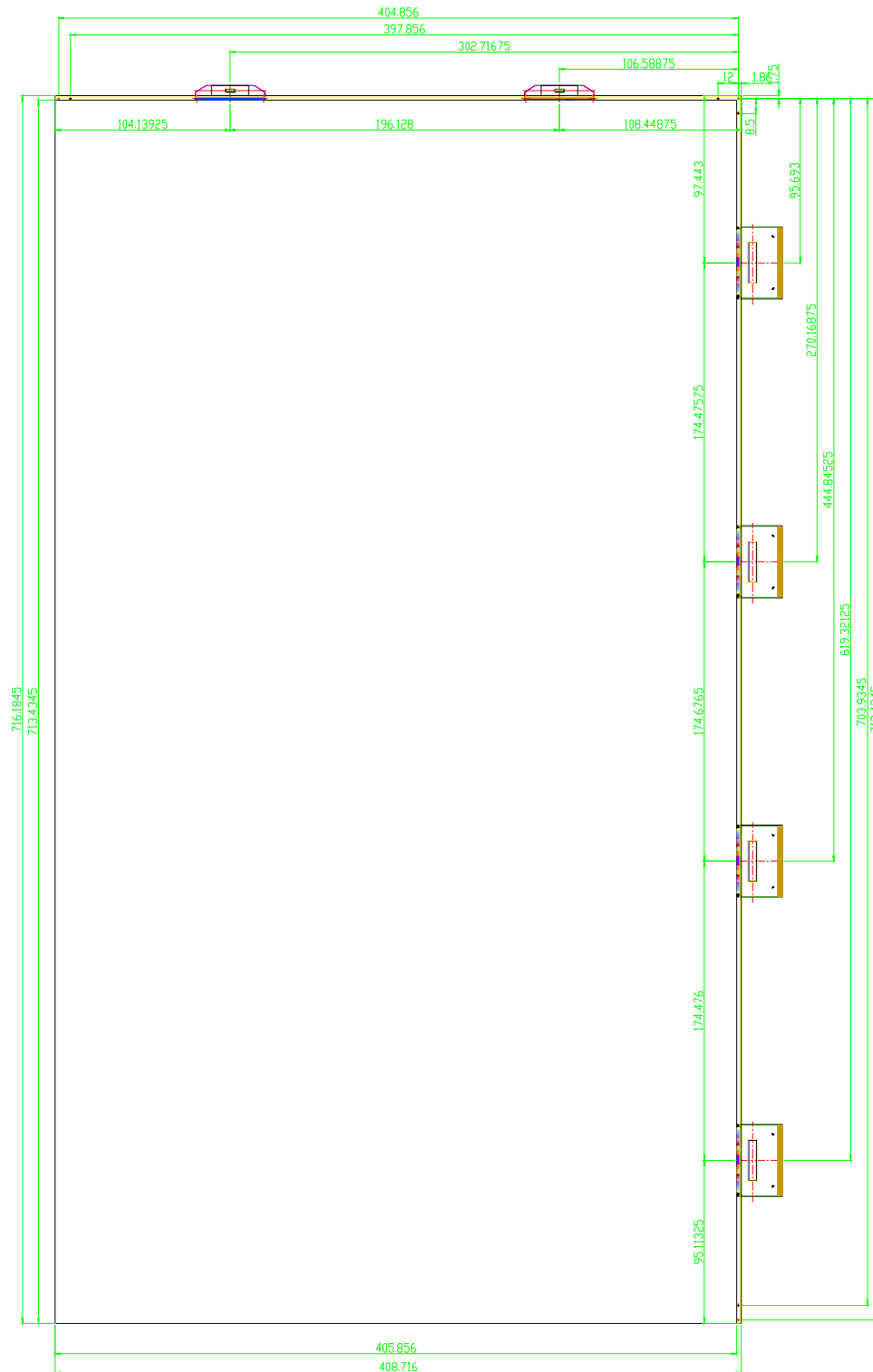
FIG4 Viewing Angle





## 5. Open Cell Drawing





## 6. Reliability Test Items

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60°C, 300hrs
2	Low temperature storage test	3	-20°C, 300hrs
3	High temperature operation test	3	50°C, 300hrs
4	Low temperature operation test	3	-5°C, 300hrs
5	Vibration test (non-operation)	3	Wave form: random Vibration level : 1.0G RMS Bandwidth : 10-300Hz Duration : X,Y,Z 10min per axes X,Y,Z: Horizontal, face up
6	Shock test (non-operation)	3	Shock level 50G ,20ms ±X,Y,Z axis Waveform: half sine wave Direction: One time each direction
7	Vibration test (With carton)	1CTN/7PCS	Random wave (1. 5Grms 10~200Hz) Duration : X,Y,Z 30min per axes
8	Drop test (With carton)	1CTN/7PCS	Height: 20.3cm (ASTMD4169-I) 1 corner, 3 edges, 6 faces (refer ASTM D 5276)

Note: Test item 1~6 RA tests are done on AUO T320XVN01.0 panels.


## 7. Packing

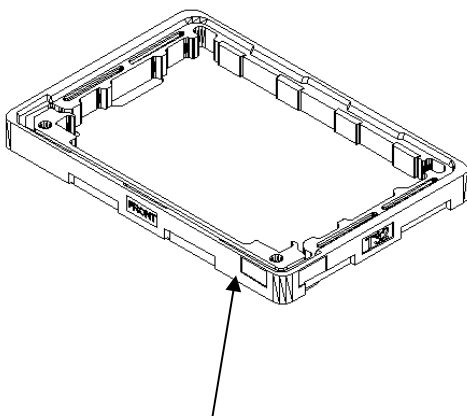
Open cell shipping label (35\*7mm)



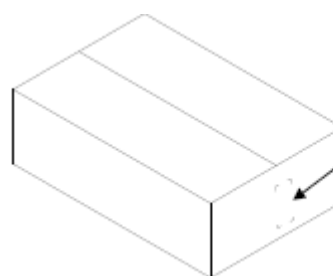
1. S/N number
2. Grade
3. Manufacture Fab.
4. Manufactured date
5. Model name

### B. Carton Label:

<p>AU Optronics</p> <p>MODEL NO: T320XVN01.0</p> <p>PART NO: 91.32T21.0XX</p> <p>CUSTOMER NO:</p> <p>CARTON NO: </p> <p>Made in XXXXXX      *XXXXXX-XXXXXXXXXXXX*</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">RoHS</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px; text-align: center;">Pb</div> </div>
---	---

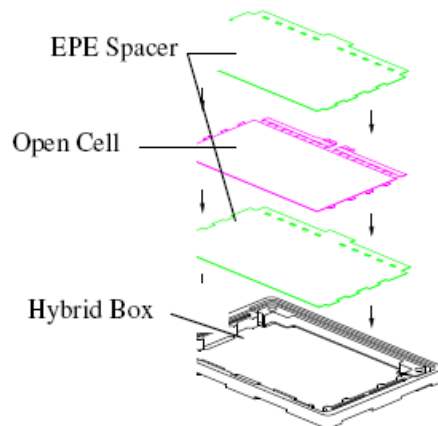


Carton label location



Carton label location

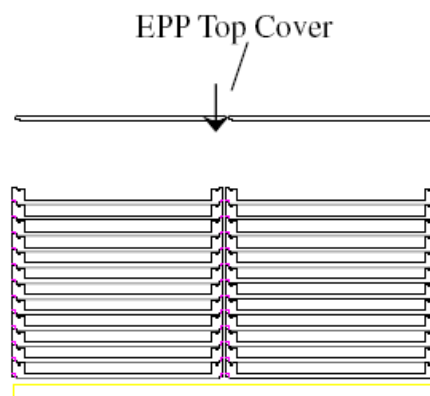
## Packing Process:



9 pcs of SKD & 10 pcs of spacers per 1 box



9 Pcs/Box, after stack 9 pcs of SKD, then put PET top cover on it.



Pallet Dimension : 1200 x 1000 x 145 mm

24 Boxes/Pallet, after stack 24 boxes, then put EPP top cover on it.

## 8. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD Open Cell unit.

### 8-1 MOUNTING PRECAUTIONS

- (1) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the cell. And the frame on which a cell is mounted should have sufficient strength so that external force is not transmitted directly to the cell.
- (2) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (3) You should adopt radiation structure to satisfy the temperature specification.
- (3) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (4) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (5) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (6) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (7) Do not open the case because inside circuits do not have sufficient strength.

### 8-2 OPERATING PRECAUTIONS

- (1) The open cell unit listed in the product specification sheets was designed and manufactured for TV application
- (2) The spike noise causes the mis-operation of circuits. It should be lower than following voltage:  
 $V = \pm 200\text{mV}$  (Over and under shoot voltage)
- (3) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (4) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (5) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (6) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (7) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

### 8-3 ELECTROSTATIC DISCHARGE CONTROL

Since a open cell unit is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

## 8-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

## 8-5 STORAGE

When storing open cell units as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the open cell unit to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

## 8-6 HANDLING PRECAUTIONS FOR PROTECTION FILM OF POLARIZER

The protection film of polarizer is still attached on the surface as you receive open cell units. When the protection film is peeled off, static electricity is easily generated on the polarizer surface. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.